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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

LAROSE, COLIN M

ART UNIT PAPER NUMBER

2623

DATE MAILED: 01/28/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/410,737

Applicant(s)

LE ET AL.

Examiner

Colin M. LaRose

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 December 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-65 is/are pending in the application.
- 4a) Of the above claim(s) 1-9, 25-29, 48-50, 57-59 and 62 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 30-34 is/are allowed.
- 6) ☒ Claim(s) 10-24, 35, 39-43, 45-47, 51, 52, 55, 56, 60, 61, 64 and 65 is/are rejected.
- 7) ☒ Claim(s) 36-38 and 44 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5,6.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Group II in Paper No. 9 is acknowledged.

Priority

2. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 10, 11, 15, 18, 35, 39, 51, 55, 60, and 64 are rejected under 35 U.S.C. 102(b) as being anticipated by "Region Growing and Region Merging Image Segmentation" by Ikonomakis et al. ("Ikonomakis").

Regarding claims 10, 35, 51, 55, and 60, and 64 Ikonomakis discloses a method of segmenting an image comprising:

allocating pixels as seeds (column 2, page 299, lines 1+: start with a set of seed pixels);

growing regions from said seeds so as to segment the image into a number of regions

(column 2, page 299, lines 2+: grow regions from the seeds),

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wherein a number of pixels that border said growing regions are considered (column 2, page 299, lines 7+: seed pixel is compared to its 8 neighbors) and that pixel of said number that is most similar in a property to a region it borders is appended to that region and the said property of the appended region is updated (column 2, page 299, lines 8+: border pixels that satisfy a similarity function (including the most similar pixel) are appended to the region and changed to the seed pixel value) and said growing step is repeated until no pixels bordering the growing regions are available (column 2, page 299, lines 22+: growing step is repeated until no border pixels are left).

Further regarding claims 35, 55 and 64, Ikonomakis discloses allocating pixels as seeds in those areas of the image as a function of the luminance of the pixels within those areas (column 2, page 299, lines 5-22: a first seed pixel produces a first region of homogeneity, then a second pixel outside of the first region is specified as a second seed pixel, and subsequently produces a second region of homogeneity different from the first region; thus the seed pixels are allocated as a function of the luminance of homogeneous areas), wherein fewer seeds are allocated to those areas of the image having pixels of homogeneous luminance (each region is allocated only one seed; therefore, areas of the image having pixels of homogeneous luminance (i.e. encompass only one region) are allocated fewer seeds than those regions that are not homogeneous (i.e. encompass more than one region) and wherein said seeds form growing regions (i.e. each subsequent seed forms a new growing region).

Regarding claims 11, 15, and 39, Ikonomakis discloses said property is the grey value (column 2, page 299, lines 25+: homogeneity function considers difference of grey levels).

Luminance is substantially equivalent to grey value.

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Regarding claim 18, Ikonomakis discloses merging the grown regions which have similarities (column 1, page 300, lines 21+: after growing, merging is done).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ikonomakis in view of "Image Segmentation and Approximation Through Surface Type Labelling and Region Merging" by Lim et al. ("Lim").

Regarding claim 19, Ikonomakis discloses
determining for each pair of neighboring grown regions a clique function value
representative of the similarity of said property of said pair of neighboring grown regions; and

merging a pair of regions to produce a merged region if the clique function is less than a predetermined threshold (column 1, page 300, lines 32+: homogeneity (clique) function between neighboring regions and a merging threshold is used to merge regions whose value is less than the threshold – this includes the selection of the regions with the smallest clique function value and the comparison of their clique values to the threshold to determine if the regions should be merged).

Ikonomakis does not expressly disclose updating the merged regions' clique functions.

Lim discloses a similar method for merging segmented regions. Lim teaches selecting the region with the lowest measure of dissimilarity and repeatedly merging each subsequent selected region on the condition that the measure of dissimilarity does not exceed an error threshold value (column 1, page 1381, paragraph 5). Also, when two regions are merged, the measures of dissimilarity between the new region and its neighbors are updated.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the merging sub-steps of Ikonomakis by Lim to achieve the claimed invention since Lim teaches that the claimed merging sub-steps have good performance, a lower approximation error, and a reduced processing time (column 2, page 1381, paragraph 1).

8. Claim 12-14, 16, 17, 20-24, 40-43, 46, 47, 52, 56, 61, and 65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ikonomakis in view of “Seeded Region Growing” by Adams et al. (“Adams”).

Regarding claims 12, 20, 40, 46, 52, 56, 61, and 65, Ikonomakis discloses a method of segmenting an image comprising:

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allocating pixels as seeds (as in claim 10);

growing regions from the seeds, wherein the growing comprises:

scanning pixels that border the growing regions and determining for each border pixel, a value indicative of the similarity of the luminance of said scanned pixel and the corresponding luminance of a growing region that the border pixel borders (column 2, page 299, lines 7+: the eight pixels that border the seed pixel (which is in the growing region) are scanned and the similarity of the border pixels to the seed pixel in terms of luminance is determined by $|G - G_s|$);

selecting a pixel that has a minimum said value and appending said selected pixel to said growing region it borders (column 2, page 299, lines 27+: a selected border pixel is appended to the growing region if it has a minimal difference value);

updating the said corresponding luminance of the appended region (column 2, page 299, lines 9+: the luminance value of an appended pixel is changed to the seed pixel value);

repeating the growing steps until there are no more border pixels (column 2, page 299, lines 23+: growing steps are repeated until no border pixels are left).

Ikonomakis does not expressly disclose generating a list of the border pixels and scanning the pixels of the generated list.

Adams discloses a similar region-growing method for segmenting images that comprises generating a sequentially sorted list, or SSL, which contains neighboring pixels of growing regions (column 2, page 642, lines 12+). Neighboring pixels are stored in the list according to their similarity measures. The list is scanned in a predetermined manner, and pixels are removed until the list is empty.

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It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Ikonomakis by Adams to generate a list of border pixels and scan the pixels of the list as claimed since Adams shows that utilizing a linked list of pixel addresses facilitates the labeling of boundary pixels into the their corresponding regions.

Further regarding claims 46, 56, and 65, Ikonomakis discloses allocating pixels as seeds in those areas of the image as a function of the luminance of the pixels within those areas (column 2, page 299, lines 5-22: a first seed pixel produces a first region of homogeneity, then a second pixel outside of the first region is specified as a second seed pixel, and subsequently produces a second region of homogeneity different from the first region; thus the seed pixels are allocated as a function of the luminance of homogeneous areas), wherein fewer seeds are allocated to those areas of the image having pixels of homogeneous luminance (each region is allocated only one seed; therefore, areas of the image having pixels of homogeneous luminance (i.e. encompass only one region) are allocated fewer seeds than those regions that are not homogeneous (i.e. encompass more than one region) and wherein said seeds form growing regions (i.e. each subsequent seed forms a new growing region).

Regarding claims 13, 14, 21, 22, 41, and 42, Ikonomakis teaches selecting a first pixel having a said value below a minimum threshold (column 2, page 299, lines 8+: bordering pixels that have said value below the threshold are selected for appending to the growing region). Further regarding claims 14, 22, and 42, the bordering pixel having the minimum value of all bordering pixels is included in the group of selected pixels.

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Regarding claims 16 and 23, Adams teaches the claimed similarity measure (equation 1, page 642).

Regarding claim 17, Ikonomakis discloses the said value is determined in accordance with a metric in color space (equation 1, page 300).

Regarding claims 24, 43, and 47, Ikonomakis discloses merging grown regions as claimed (column 2, page 299, lines 21+).

9. Claim 45 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ikonomakis and Adams, as applied to claim 43, and further in view of Lim.

Regarding claim 45, see the explanation for claim 19.

Allowable Subject Matter

10. Claims 36-38 and 44 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding claim 36, both Ikonomakis and Adams are silent to the distribution step comprising each of the dividing, allocating, and storing sub-steps, as claimed.

Regarding claim 44, Ikonomakis and Adams are silent to splitting, merging, and outputting, as claimed.

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11. Regarding claims 30, 54, and 63, Ikonomakis and Admas are silent to storing a segmented image in a queue, performing the claimed sub-steps until the queue is empty, merging divided rectangular areas as claimed, and outputting vertices as claimed.

Claims 30-34, 54, and 63 are allowable.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Colin M. LaRose whose telephone number is (703) 306-3489. The examiner can normally be reached Monday through Thursday from 8:00 to 5:30. The examiner can also be reached on alternate Fridays.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au, can be reached on (703) 308-6604. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9314.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the TC 2600 Customer Service Office whose telephone number is (703) 306-0377.

CML

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24 January 2003


AMELIA M. AU
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